NOTES FROM PACIFIC COAST OBSERVATORIES

The Orbits of the Spectroscopic Components of Boss 4602

This star ($\alpha = 18^h\ 07.5m$, $\delta = +79°59'$, photographic magnitude 6.6, type F_5) is one of the first twelve binaries discovered at the Dominion Astrophysical Observatory at Victoria, B. C., the announcement of which appeared first in the *Journal of the Royal Astronomical Society of Canada* for November 1918.

Dr. J. S. Plaskett secured five plates of the star, in the program of radial velocity determinations, between June 19 and July 21, 1918. His measures of these five spectrograms revealed the binary character of the star. Between July 1, 1919, and September 18, 1919, 28 plates were secured. All of these, as well as those secured by Dr. Plaskett in 1918, were measured on the Hartmann Comparator, using a sky or a Mars standard.

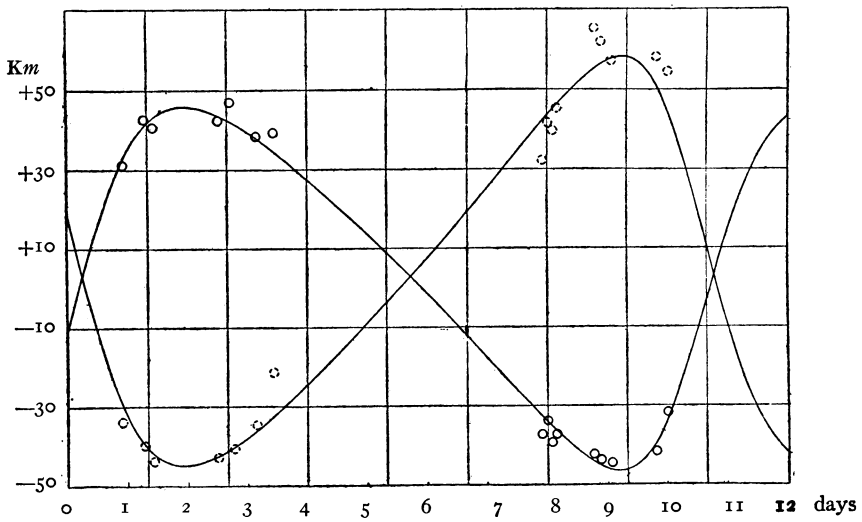
From the measures of the first 14 or 15 of the 1919 plates, together with Dr. Plaskett's measures of 1918, the period was found to be very close to 10.5 days. This made it possible to get the remaining plates well distributed along the velocity curve. The velocities did not, however, agree well with any elliptic curve, altho those at nearly the same phase showed as reasonable agreement as was to be expected. Measures of a plate secured on September 12, 1919, on the Hartmann comparator proved an exception to this rule and a closer examination of the plate revealed close companion lines to at least ten of the lines. A re-examination of all of the previous plates, including those secured by Dr. Plaskett in 1918, showed that on seven of these plates from four to ten lines showed double. Since the lines of the two components are just separable, for one-prism dispersion, and besides this, only those lines which are most intense show at all for the secondary component, it is easy to see why they were overlooked on the few plates on which from two to ten show at all.

The writer had to leave Victoria on September 18, 1919, to resume his duties at the University of Washington and bad weather prevented securing more plates, at phases which would show the double lines, before October 15, and after that it was inadvisable to attempt to get any more plates in 1919, owing to the unfavorable position of the star for observation. However, in April, 1920,

Mr. Harper and Dr. Plaskett kindly secured three more plates at such phases as to show the lines double. Again in August, 1920, four more plates were secured at such phases as to show some of the lines double. Sixteen plates in all were therefore secured which show double lines and the orbit is based entirely on the measures of these sixteen plates. The remaining twenty-six plates were measured on either the Hartmann comparator or the Gaertner Measuring Machine or on both, but none of these measures was used in the final computations for the orbital elements. The unused measures exhibit the usual behavior of lying nearer the gamma line, being almost on the gamma line for nearly a day near the points where the two velocity curves intersect.

The lines of the secondary component are quite faint, whereas those of the principal component are rather diffuse and much more numerous. The probable error of a plate for the principal component is ± 2.36 and for the secondary ± 4.65 km. per second. The mass of the secondary component is 0.903 times that of the principal component.

From the preliminary elements given, observation equations were built up according to the notation of Lehman-Filhes, modified to suit the case of double spectra and a least squares solution



[FIG 1. RADIAL VELOCITY CURVES OF BOSS 4602 SHOWING INDIVIDUAL OBSERVATIONS.

effected. Since the observations extended over parts of three seasons, the period was also included in the solution. This necessitated treating all the observations separately.

The least squares solution gave corrections to the preliminary elements, as given in the following table. One solution was deemed to be all that was warranted from the data at hand, as judged by the fair agreement of the final ephemeris residuals with those obtained by substitution in the observation equations. The sum of the squares of the residuals for the observed places was reduced from 1757 to 1082 or about 38 per cent.

TABLE OF ELEMENTS

ELEMENT	PRELIMINARY	FINAL	
Period.....P	10.527 days	10.5217	±0.0018 days
Eccentricity.....e	0.30	0.314	±0.014
Longitude of apse.....ω_1	270°	256°.76	±4°.38
Longitude of apse.....ω_2	90°	76°.76	±4°.38
Velocity of system.....γ	+1.88 km. per sec.	+2.93	±0.62 km. per sec.
Semi-amplitude primary.K_1	47 km.	46.16	±0.83 km.
Semi-amplitude secondary.....K_2	50 km.	51.50	±1.32 km.
Periastron passage.....T	J.D.2,421,764.592	J.D. 2,421,764.6481	±0.1112
Semi-major axis...$a_1 \sin i$		6,341,000 km.	
Semi-major axis...$a_2 \sin i$		7,074,000 km.	
Mass primary....$m_1 \sin^3 i$		0.457 ⊕	
Mass secondary..$m_2 \sin^3 i$		0.413 ⊕	

The graph shown represents the velocity curves using the final elements. Individual observations are plotted. An interesting problem, reserved for the future, will be to re-determine these orbits from plates obtained with higher dispersion.

I wish here to express my appreciation of the kindness shown me by Dr. Plaskett and all the members of his staff at the Dominion Astrophysical Observatory at Victoria during my stay at the Observatory for twelve weeks of the summer of 1919 and six weeks of the summer of 1920. Every possible facility was extended to aid me in the prosecution of the work on Boss 4602 and on other spectroscopic binaries on which I am working, the results of which work will appear as soon as completed.

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